WHAT IS RCOC's FAST-TRAC?

In June 1992, the Road Commission for Oakland County threw a switch that turned on a high-tech traffic signal system known as FAST-TRAC (Faster And Safer Travel through Traffic Routing & Advanced Controls) at 28 intersections in the city of Troy. Today, the FAST-TRAC system – which is part of RCOC's Intelligent Transportation Systems (ITS) program -- is in place at some 675 intersections throughout Oakland County, making it the second largest deployment of an "adaptive" traffic signal system in North America.

FAST-TRAC is a traffic control strategy designed to reduce traffic delays and maximize the use of available roadway capacity, thereby improving the efficiency of the road system.

The system uses telephone lines and a wireless network to communicate between a regional computer and the traffic signal controller at each FAST-TRAC intersection. Each intersection is equipped with vehicle detectors that let the system know when vehicles are present. The detectors count vehicles, and FAST-TRAC uses this information to decide how much green time each approach to a signalized intersection should have. This is recomputed every time the signal changes from green to red in order to move traffic most efficiently. FAST-TRAC also coordinates timings at adjacent intersections to provide for the best possible flow of traffic.

The vehicle detection system used by FAST-TRAC involves a system known as video image detection. This system uses video cameras on poles at the intersection. The cameras record images of the vehicles passing through the intersection. However, no human sees the images. Rather a computer analyzes the video to determine what is in the picture, comparing frames of video with data stored in the computer's memory to see if the video has changed. If it has changed, the computer sends a signal to the traffic signal controller. The traffic signal controller then recognizes that a vehicle is present. With more than 1,300 of these cameras "in the air," RCOC has the largest system of video vehicle detection in the world for traffic management.

There are also some intersections where "loop detectors" are used instead of cameras. Loop detectors are loops of wire that are buried in the pavement. The loop generates a magnetic field that changes when a vehicle passes through it. An electronic device detects this change and a signal is sent to the controller. The controller then responds in the same way it does with a detection from the cameras. We do not use loops in older pavement because the older pavement is usually not in very good condition, which leads to premature loop failure. Also, loops cannot be repaired during the cold weather months.

What is FAST-TRAC?

FAST-TRAC (**F**aster **A**nd **S**afer **T**ravel through **T**raffic **R**outing and **A**dvanced **C**ontrols) is the second largest traffic management system in North America. It utilizes pole-mounted video imaging devices and loop detectors buried in the pavement to monitor traffic flow at some 675 intersections in Oakland County. The information collected by the video imaging devices and loop detectors is fed to computers that automatically adjust traffic signal timing (how long the signal remains green or red) to most efficiently move the actual traffic present through the intersection. In many places, entire corridors are linked for even greater efficiency. The system is improving mobility and safety on Oakland's increasingly congested roads.

Road Commission for Oakland County's FAST-TRAC System

(Faster And Safer Travel through Traffic Routing & Advanced Controls)

FAST-TRAC is:

- One of the first & largest local road agency ITS deployments in the United States.
- The 2nd largest fully adaptive traffic signal system in North America.
- The largest application of video-imaging vehicle detection for traffic control in the world.
- The first real-time Web-based traffic congestion map for arterial roads in North America.
- A traffic management system proven to reduce congestion and serious injury accidents.

History:

- 1992: Switched on at first 28 intersections, making it the first fully adaptive signal system in U.S.
- Mid-1990s: First in-vehicle navigation system demonstration using Siemen's Automotive's Ali-Scout route guidance system (a beacon-based system providing vehicle routing taking into account delays resulting from road construction projects and congestion).
- 1999: Launch of the Web-based real-time traffic congestion map.
- 2012: FAST-TRAC is in place at more than 675 intersections throughout Oakland County.

The Future:

- Intended to be expanded to all 1,500 signals in Oakland County.

Benefits:

- Reduces serious injury accidents at intersections by more than 50%.
- Reduces intersection delays by up to 26%.
- Reduces motorist travel time by up to 32%.
- Reduces "stopped vehicle" delays by up to 20%.

How it works:

- FAST-TRAC intersections are equipped with vehicle detectors that alert the system when vehicles are present. The detectors count vehicles and FAST-TRAC uses this information to determine how much "green time" each approach to a signalized intersection should have. This is recomputed every time the signal changes from green to red in order to move traffic most efficiently.

- FAST-TRAC uses a system known as video imaging to detect vehicles at intersections: Video cameras on poles record images of the vehicles passing through the intersection. A computer instantaneously analyzes the video to determine what is in the picture, comparing frames of video with data stored in the computer's memory to see if the video has changed. If it has changed, the computer sends a signal to the traffic signal controller. The controller recognizes the number of vehicles present in each direction and adjusts the signal timing to most efficiently accommodate those vehicles. No human sees the images.

ROAD COMMISSION for OAKLAND COUNTY

FAST-TRAC

FAST-TRAC BENEFITS FACT SHEET

Below are some of the documented benefits resulting from the FAST-TRAC system.

All the statistics are quoted from reports generated by Michigan State University which is under sub-contract to the University of Michigan. These independent evaluations are mandated by the Federal Highway Administration.

ACCIDENT SEVERITY REDUCED - *City of Troy*

The introduction of FAST-TRAC's impact on accidents: The number of accidents is not significantly different. However, the type and severity of the accidents has changed. The chance that an accident results in serious injuries to motorists is much lower.

Percentage of accidents that result in serious injury:	Before FAST-TRAC:	9%
	After FAST-TRAC:	4%

NOTE: This is a reduction of over **50%** in serious-injury type accidents.

TRAVEL TIME REDUCED - *Orchard Lake Corridor*

The following travel time improvements have been documented after the installation of FAST-TRAC:

	Northbound	Southbound
	Percent Reduction	Percent Reduction
AM Peak	**20**	**9**
Off-Peak	**32**	**15**
PM Peak	**7**	**7**

INTERSECTION DELAYS REDUCED

- ***Orchard Lake* at *Lone Pine (West Bloomfield Twp.)***

The following reduction in overall intersection delay has been recorded:

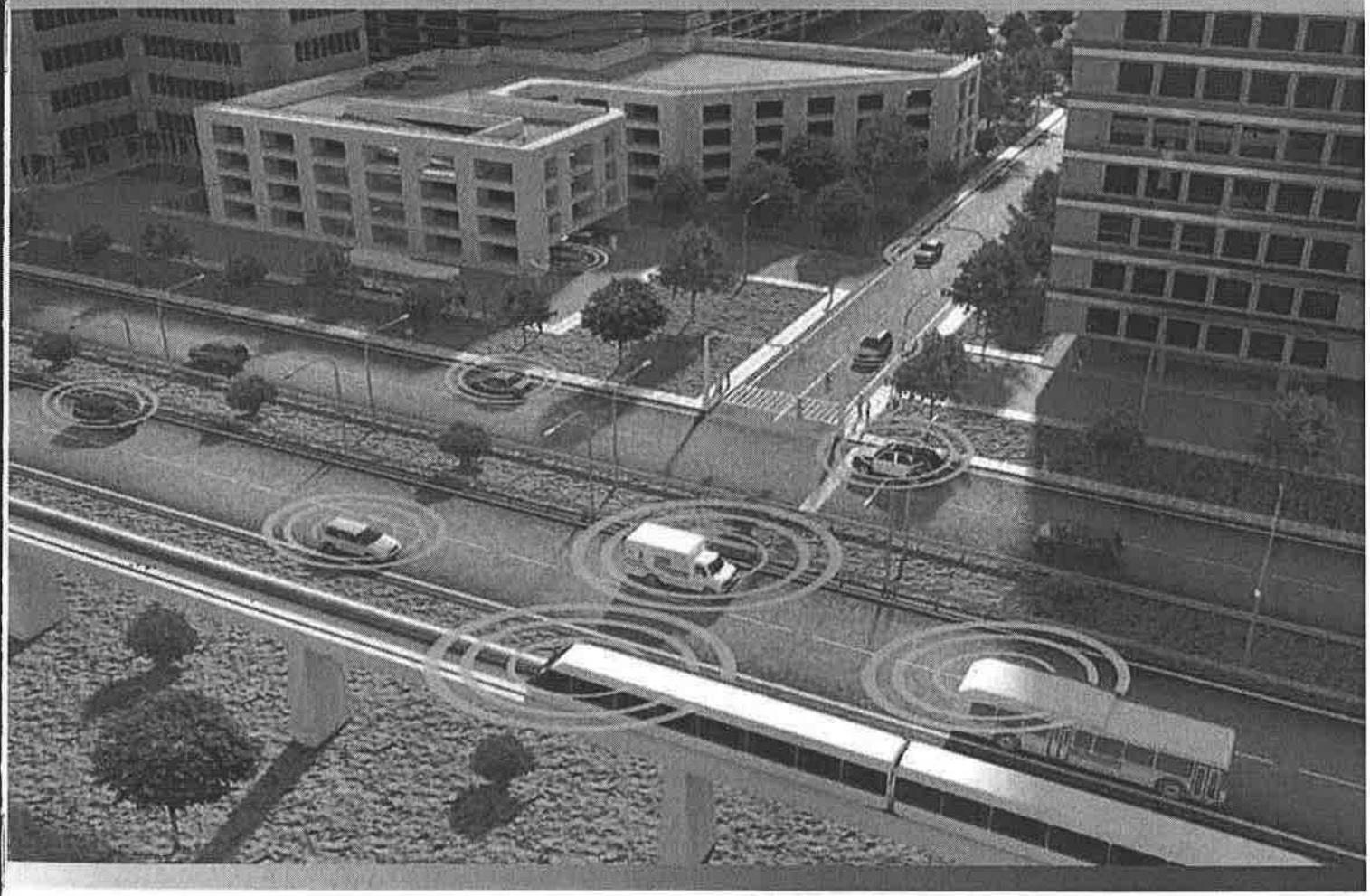
Off-Peak	**26%**
PM Peak	**17%**

STOPPED VEHICLE DELAYS REDUCED - *Pontiac Trail at 9 Mile (South Lyon)*

The amount of time that vehicles sit idle at this intersection has been reduced by **20%.**

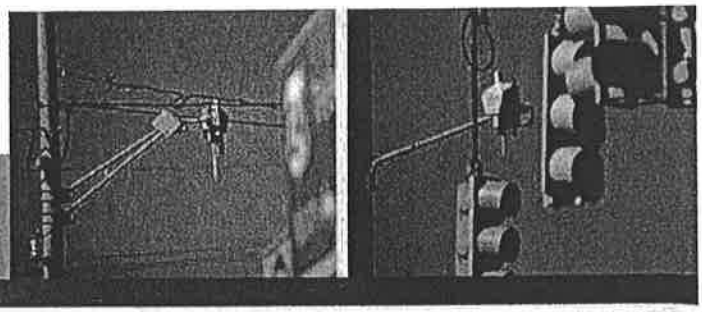
Connected Vehicle TEST BED

CONNECTED VEHICLE INFRASTRUCTURE & COMPONENTS | SAFETY, MOBILITY, & ENVIRONMENTAL APPLICATIONS | IN-VEHICLE DEVICES



Testing Connected Vehicle Technologies in a Real-World Environment

A One of a Kind Testing Environment



What Are Connected Vehicles?

Connected vehicle technology leverages the potentially transformative capabilities of wireless communication to make surface transportation safer, smarter and greener. The trend is inevitable - connected vehicles are the new wave of intelligent transportation technology to address up to 80 percent of unimpaired driver crashes while potentially reducing the estimated 4.8 billion hours Americans spend in traffic each year.

The U.S. Department of Transportation (USDOT), in cooperation with the automotive industry and other partners, strives toward the goal of enabling networked wireless communications among all vehicles types and is promoting development and deployment by the private and public sectors.

Real-Life Conditions. Open Testing Environment. State of the Art.

The Connected Vehicle Test Bed is a federally-funded resource available to developers to test how connected vehicle technologies will perform under real-world operating conditions. The Test Bed has been established to provide a real environment where intersections, roadways and vehicles are able to communicate through wireless connectivity.

It consists of a network of 50 roadside equipment (RSE) units installed along various segments of live interstate roadways, arterials, and signalized and unsignalized intersections, in Novi, Michigan - just 30 miles outside of Detroit. These RSEs communicate messages over 5.9 Ghz Dedicated Short Range Communication (DSRC).

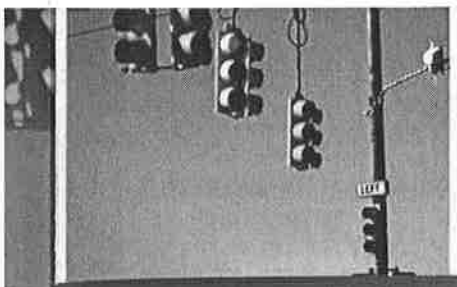
The Mission: Provide a facility where users can test new hardware and software for the advancement of connected vehicle technology.

Developers and manufacturers are actively being sought by the connected vehicle research community to develop, test and demonstrate advances in the technology. The Connected Vehicle Test Bed will help fill in the missing pieces required to run a fully operable and stable connected vehicle environment. Developers are encouraged to advance and refine the technologies to make them function better and make them easier to implement.

Why Is the Connected Vehicle Test Bed Right for You?

The Connected Vehicle Test Bed provides cutting-edge technology for users to conduct a variety of tests, including Signal Phase and Timing (SPaT) communications; security system operations; and other connected vehicle applications, concepts, and equipment. In addition, the Test Bed offers:

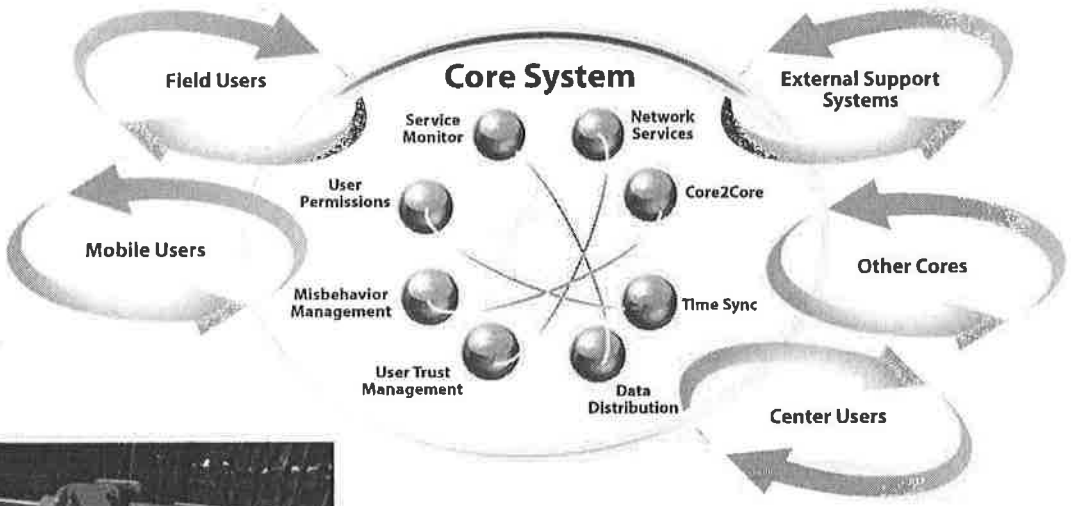
- Connected vehicle infrastructure and equipment to perform tests at **no cost to the user**.
- Preexisting agreements with local agencies **eliminating the need for complex testing arrangements** with roadway operators.
- **Highly skilled staff** who can help users test a variety of complex scenarios.

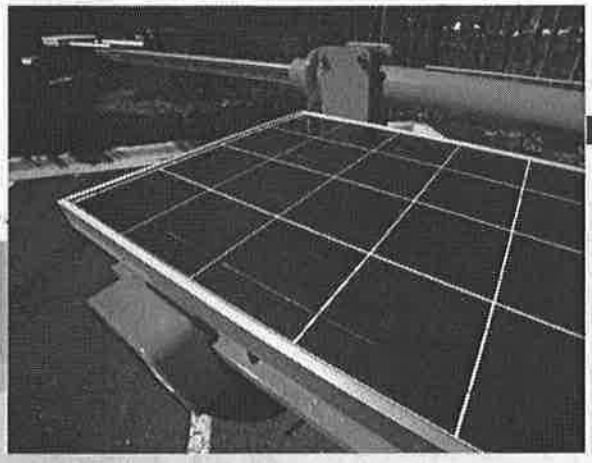


Customer-Driven Focus: Keeping Up With the State of the Practice

The New Core System

The diagram below provides an architectural overview of the Connected Vehicle Test Bed components. It is comprised of a core system that is utilized by a number of external systems and users.





Updated Standards. Open Architecture. New Services and Applications

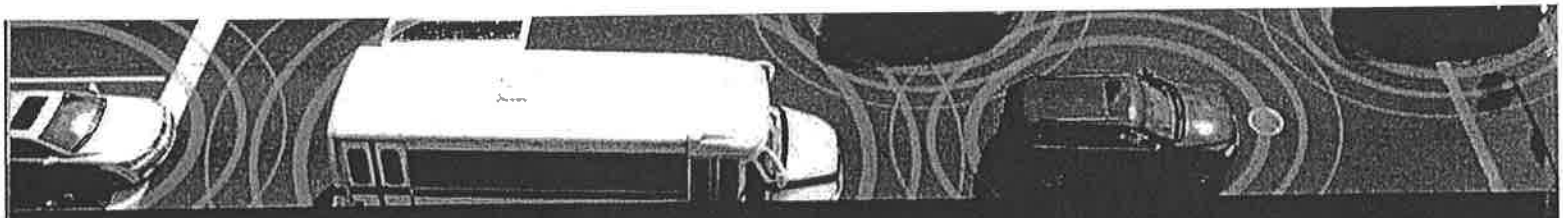
Thanks to the feedback of the Connected Vehicle Test Bed user community, the Test Bed is undergoing upgrades and enhancements to support the evolving needs of our users. It will be the only testing environment of its kind to advance with the state of the practice providing developers with a cutting-edge model operating environment. These upgrades will provide a better level of service and offer additional functionalities, including:

- Security Certificate Management System (SCMS).
- Local Certificate Distribution System (LCDS).
- Improved IPv6 functionality and capabilities.
- Roadside Equipment (RSE) Data-Logging.
- New RSEs supporting improved messaging, logging, and IPv6 gateway functionality.
- Vehicles equipped with a universal connected vehicle device mounting system.
- Future upgrades to support mobility applications, other wireless data communications including WiFi and/or cellular.

As the Test Bed transitions to the new core architecture, some services are still available for use:

- 22 intersections broadcasting SPaT and GID information.
- 3 new portable RSE units that allow for private testing or for testing in atypical locations, such as a parking lot.
- Data Center running 24-7 and on 99% uptime.
- Test vehicles and drivers, upon request.
- On-site experts with years of experience in ITS and connected vehicle systems.

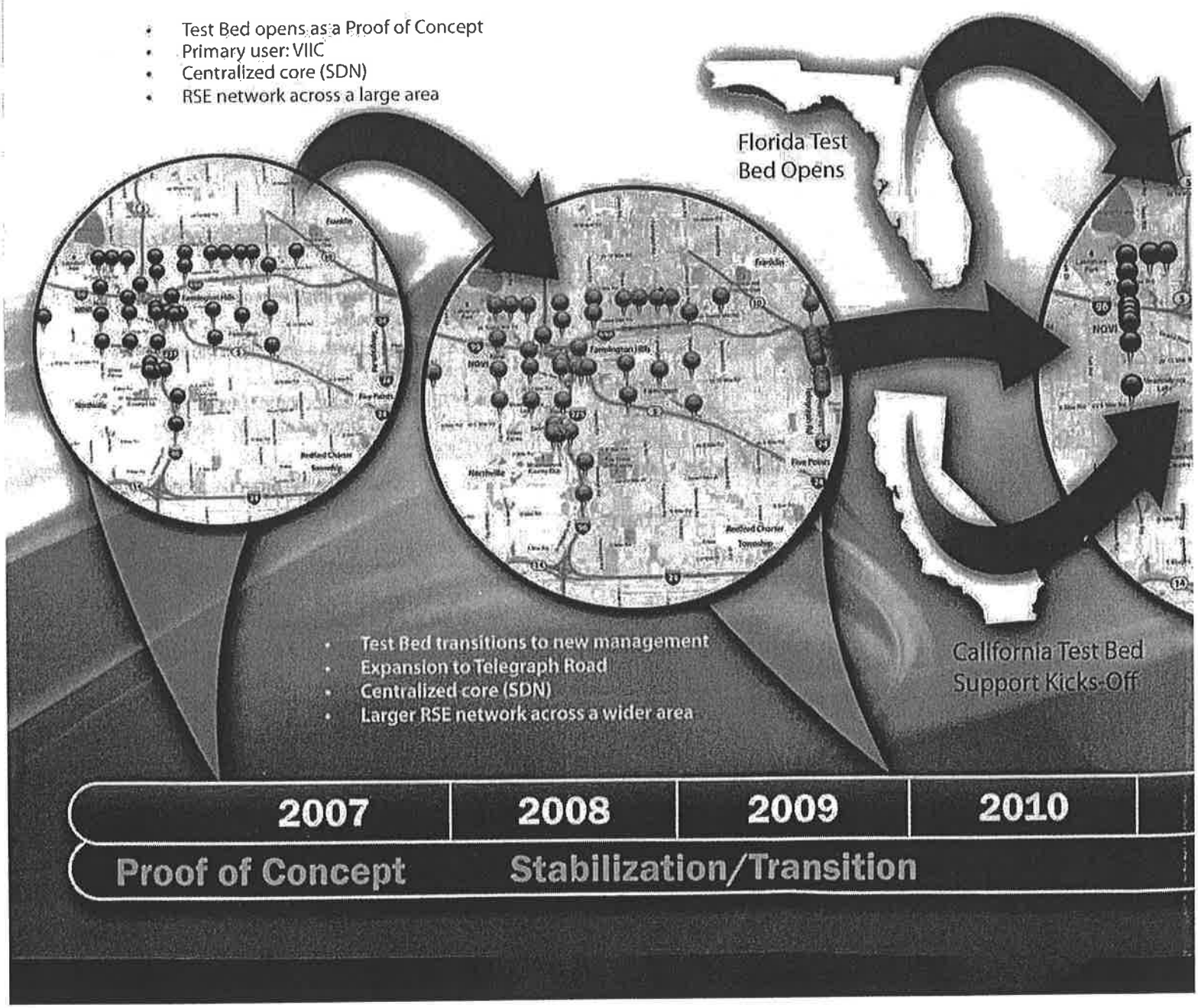
Our goal for these improvements is to provide real-world conditions, state-of-the-art infrastructure, interference-free and continuous wireless connectivity, variable road environments, and much, much more – all part of a system that can be tailored to meet the specific needs of today's users.

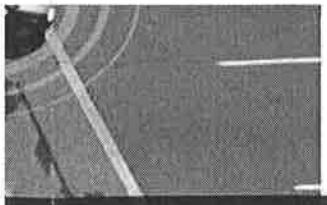


TEST BED PROGRESSION: TECHNOLOGICALLY DRIVEN

The Test Bed Operations Team is creating and implementing technical solutions to keep up with changing technological trends while meeting users' diverse performance needs. Our goal is to create and maintain a testing environment that is customizable to each unique user's requirements, which includes:

- Establishing partnerships with other affiliated test beds, closed-loop testing environments, and proving grounds;
- Coordinating with the simulation and prototyping capabilities of laboratories such as the Saxton Operations Laboratory at the Turner Fairbank Highway Research Center;
- Modifying our network of RSEs and installing tester-specific software for easier access to the network and data.





VEN. CUSTOMER FOCUSED. FORWARD-THINKING.

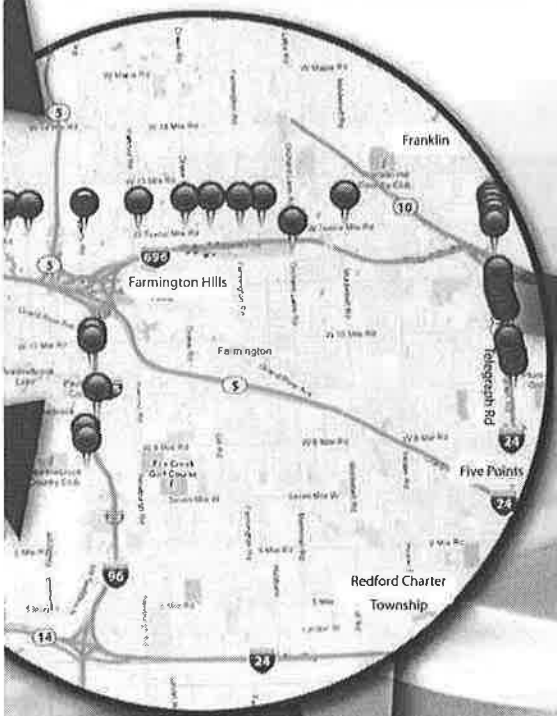
er's

Testing to Industry Standards

With the new standards and core architecture, the Connected Vehicle Test Bed will feature a more decentralized, simplified, and open structure. We also have begun adding new security features as well as new hardware and software applications. The Connected Vehicle Test Bed strategy will provide a dynamic, evolving environment that keeps up with the state of the practice.

The Test Bed will run in accordance with the latest IEEE 1609/802 and SAE J2735 Standards and will have the mechanisms in place to test changes or modifications to some of these standards. This cannot be done in other testing environments, giving Connected Vehicle Test Bed users a unique advantage.

- Test Bed upgrades to 3.0 technology
- Incorporates user-focused design and SCMS
- Migration to the new core system begins
- Safety Pilot Model Deployment compliance
- Reduced RSE network concentrated along corridors



The Evolution Continues...

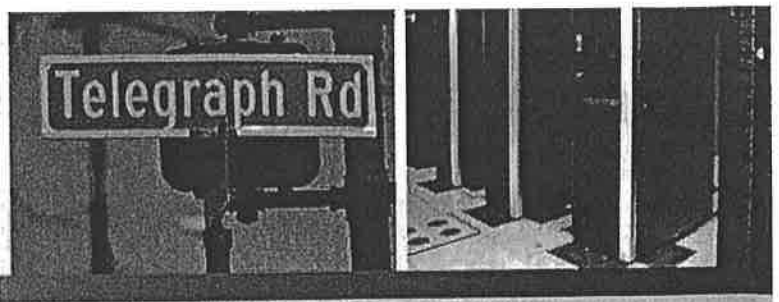
- Growing Number of Test Bed Users
- Increased Cooperation With Affiliated Test Beds in CA, NY, AZ, MN, VA, and FL
- NHTSA Agency Decision 2013

Connected Vehicle TEST BED

- Core Architecture Implementation
- Support to U.S. DOT Dynamic Mobility Applications Program
- Connected Vehicle Demonstration at ITS World Congress 2014

2011	2012	2013	2014
Test Bed 3.0			Future

Out of the Lab and onto the Road



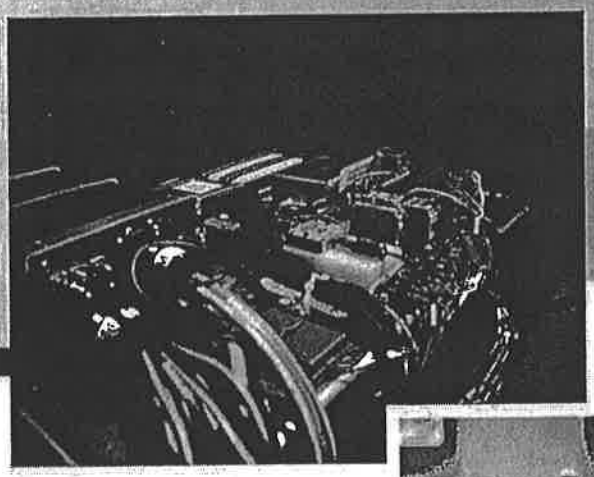
How Can You Use the Connected Vehicle Test Bed?

The Connected Vehicle Test Bed is available to customers interested in:

- Testing equipment such as vehicle awareness devices (VADs), aftermarket safety devices (ASDs), in-vehicle safety devices (ISDs), radios, and roadside equipment (RSEs).
- Developing and testing DSRC standards.
- Establishing connected vehicle security certificate credential management.
- Developing and testing applications using SPaT and Geometric Intersection Description (GID) data.

The Test Bed's functionality also allows users to test a number scenarios, including:

- **SPaT:** Developers can test their system's ability to receive and process SPaT data in a real-world environment, which is integral to the success of any Connected Vehicle system. The Test Bed offers free access to both a collection of sample SPaT messages and a series of signalized intersections equipped to broadcast SPaT data.
- **Security Management:** Test Bed users can be confident that their system communicates successfully with a Security Certificate Management System (SCMS) or by using the SCMS emulator. This provides developers with the assurance that their system can obtain properly formatted 1609 Certificates.
- **Operations:** The Test Bed saves users the high infrastructure costs associated with testing and demonstrating their systems. Developers and researchers can explore the full potential of connected vehicle technology through the versatile array of equipment the Test Bed provides, including networked RSEs, RSEs integrated with signal controllers and broadcasting SPaT data, DSRC Protocol Analyzers, and server enclaves.
- **New Equipment, Standards, Applications, and Research:** Test Bed staff have unparalleled expertise in testing connected vehicle equipment and can equip users with the knowledge they need to set up their testing and confidently navigate the new DSRC standards for which well-established testing protocols have not yet been established and testing support tools may not be available.



Who Has Used the Connected Vehicle Test Bed?

Any technology developer or researcher interested in the connected vehicle space can test at the Test Bed.

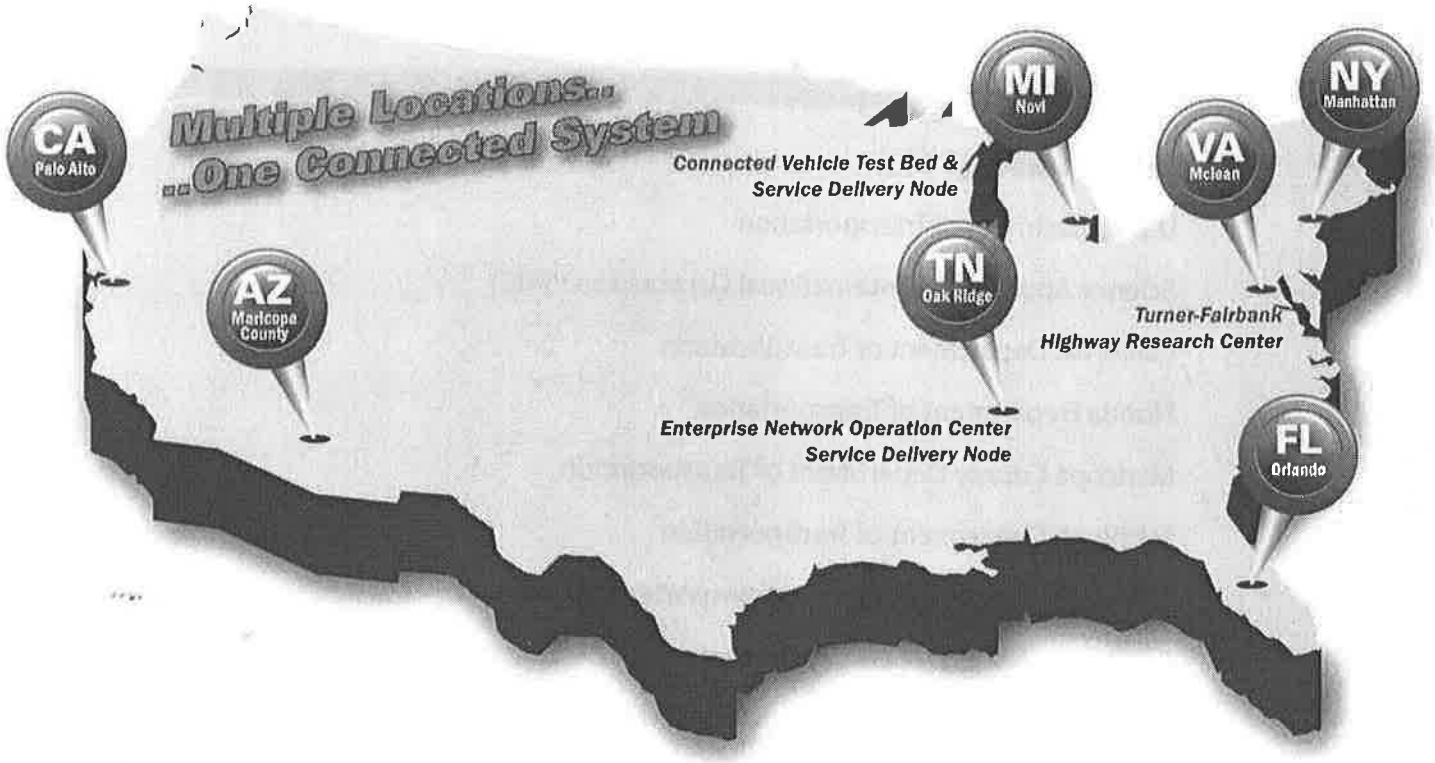
Key users in the past include the likes of:

- Denso
- Delphi
- Hirschmann
- Eaton
- Argenia
- Wayne State University
- MET Labs
- Ricardo
- University of North Texas

Auto manufacturers, suppliers, technology developers, and even those that interested in engineering as a hobby are all encouraged to use the Test Bed to advance connected vehicle technology.

We Are Expanding

In addition to the location in Michigan, Test Bed capabilities have been expanded to affiliated and interoperable test beds in Virginia, Florida, California, New York, and Arizona. These sites specialize in specific testing capabilities, such as traffic and mobility, commercial vehicles, and other functions. The Test Bed will continue to expand its capabilities with other partner demonstration sites.



How Do I Get Connected?

Step 1

ARRANGE a site visit or tour of the Test Bed by contacting the Connected Vehicle Operations Chief: Jeremy Durst

Telephone: 248.374.5098

Email: jeremy.s.durst@saic.com

Step 2

OBTAIN test plan requirements and usage forms by contacting the Connected Vehicle Test Bed User Services Manager: Gary Golembiewski

Telephone: 703.676.2383

Email: gary.a.golembiewski@saic.com

Step 3

PREPARE a test plan and complete usage forms.

Step 4

SUBMIT the usage forms and test plan to the Connected Vehicle Test Bed User Services Manager, Gary Golembiewski.

Step 5

SCHEDULE testing.

Step 6

TEST!

INFRASTRUCTURE & COMPONENTS

SAFETY, MOBILITY, & ENVIRONMENTAL APPLICATIONS

IN-VEHICLE DEVICES

Contact:
Walton Fehr, Systems Engineering and Test Bed Manager
U.S. Department of Transportation
Intelligent Transportation Systems Joint Program Office
Telephone: 202.366.0278
E-mail: walton.fehr@dot.gov

Test Bed Partners

U.S. Department of Transportation

Science Applications International Corporation (SAIC)

California Department of Transportation

Florida Department of Transportation

Maricopa County Department of Transportation

Michigan Department of Transportation

New York State Department of Transportation

Road Commission for Oakland County

Vehicle Infrastructure Integration Consortium

For more information about Connected Vehicle Test Bed, visit us online at
http://www.its.dot.gov/testbed.htm

Connected Vehicle TEST BED

Scan this QR code using a smart phone and get connected.

U.S. Department of Transportation

The Road Commission for Oakland County Traffic Operations Center (TOC)

The Road Commission for Oakland County (RCOC) Traffic Operations Center (TOC) is the "nerve center" for the one of the largest "smart" traffic signal systems in the nation, RCOC's Faster And Safer Travel through Traffic Routing and Advanced Controls (FAST-TRAC) system.

FAST-TRAC, initiated in 1992, was one of the first "adaptive" traffic signal systems in the nation, and was the first to use video-imaging vehicle detection. Today, the system remains one of the largest adaptive systems in North America, with more than 675 intersections managed by fully adaptive signals, and the largest deployment of video-imaging vehicle detection in the world with more than 2,000 cameras in the air. Independent studies of the system by institutions such as Michigan State University, the University of Michigan and the University of Detroit Mercy have documented that the system has significantly improved traffic flow, while dramatically reducing serious injury accidents.

The TOC features a wall-sized video screen and the ability to monitor seven video feeds simultaneously. It also provides a bank of computers that engineers can use to monitor the system.

The center is tied-in to multiple remote video cameras (owned primarily by the Michigan Department of Transportation), which provide the ability to visually monitor a number of key RCOC corridors and intersections remotely. Additionally, RCOC engineers can view real-time schematics for every intersection in the FAST-TRAC system, conduct remote diagnosis when problems occur and, often, make remote repairs or adjustments. The TOC also provides a live video feed to the Oakland County Homeland Security Division, helping the division better coordinate the response to emergency situations.

The TOC also provides a focal point for the FAST-TRAC system, where RCOC staff can gather to brainstorm solutions to system problems, strategize next phases for the system and discuss ways of further enhancing system operations. Additionally, the TOC provides the ideal location for explaining the complex system to the many visitors who come to learn about the FAST-TRAC system, including local school classes, both local and state public officials and transportation professionals from around the state, the nation and the world – many of whom come to learn about this cutting-edge transportation system.

To that end, the TOC provides space for visitor seating for groups of up to about 50 people. The TOC is the largest, most sophisticated traffic-management control center in the state after the Michigan Department of Transportation's Michigan ITS Center in Detroit.

What is RCOC?

The Road Commission for Oakland County maintains Michigan's largest county road system, with more than 2,700 miles of roads (including nearly 800 miles of gravel roads). Only the state highway system is larger.

RCOC also maintains:

- Approximately 80 bridges,
- Approximately 1,500 traffic signals,
- Approximately 150,000 traffic signs and
- More than 230 miles of state highway.

Safety First

As a matter of policy, major road improvement projects are conducted by the Road Commission based on a safety ranking system. At RCOC "Safety First" is more than a motto.

RCOC:

- ✔ Is separate from county general government and does not receive any revenue from property taxes
- ✔ Receives the majority of its funding from the state-collected gas tax
- ✔ Has congested roads due to the tremendous growth in the county
- ✔ Receives no direct revenue from growth and development
- ✔ Pays as much as $1.5 million to pave a mile of gravel road
- ✔ Pays approx. $6.5 million to widen one mile of road from two lanes to five
- ✔ Is located in a state with a gas tax below the national average
- ✔ Is located in a state that ranks in the bottom seven states in per capita road funding

ROAD COMMISSION for OAKLAND COUNTY

31001 Lahser Road · Beverly Hills · MI 48025

RCOC Mission Statement

RCOC strives to provide the public with leadership in:

- Safe and convenient roads
- Sound financial management
- Responsive and dependable service
- Respect for the environment
- Sensitivity to community concerns

Have a question for the Road Commission?

Call or write:

Department of Customer Services
2420 Pontiac Lake Road
Waterford, MI 48328
Toll-Free: (877) 858-4804
TDD: (248) 858-8005

OR, visit RCOC online at
www.rcocweb.org

Produced 10/12

RCOC

Fleet Management System

Using the Latest Technology to Enhance Winter Road Maintenance

ROAD COMMISSION for OAKLAND COUNTY

Fleet Management System

Fleet Management: What it is

The Road Commissino for Oakland County (RCOC) Fleet Management System (FMS) is a project that is improving the efficiency of winter road maintenance in Oakland County through the use of state-of-the-art technology.

The technology employed through the FMS includes many advancements that were developed to improve military operations. Just as they helped the military to more efficiently deploy troops, they have enabled RCOC to make the best use of its winter road maintenance fleet.

The Suburban Mobility Authority for Regional Transportation (SMART), the regional bus service, is a partner with RCOC for the FMS. SMART is providing the state-of-the-art radio system that serves as the communications backbone for the system.

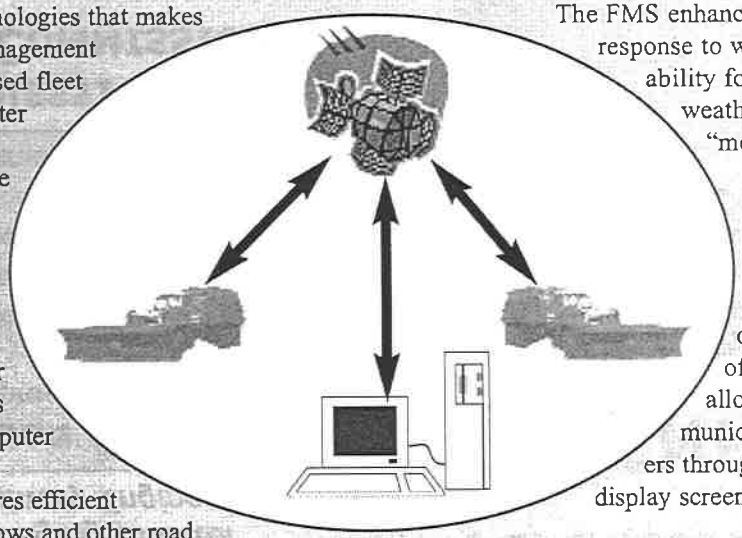
How it works

One of the key technologies that makes of the RCOC Fleet Management System is s satellite-based fleet management. Each winter maintenance vehicle is equipped with a satellite tracking device that constantly sends data to the base computer via radio. This technology allows the Road Commission to monitor real-time fleet activities and locations on a computer screen.

This capability ensures efficient deployment of snow plows and other road maintenance vehicles.

Here's how the technology does this:

- By telling management where all vehicles are at all times using global positioning system (GPS) technology,
- By alerting management to what the vehicles are doing,
- By providing comprehensive data about what the vehicles have done previously (where they have salted, plowed, etc.),
- By immediately alerting management where the nearest vehicle is (in case of breakdown or the need for an additional plow, etc.),
- By telling management how much salt each truck is spreading and
- Much more.



The FMS enhances the Road Commission's response to weather by creating the ability for each vehicle to collect weather data, thus becoming "mobile weather stations."

In addition to allowing vehicles to automatically transfer data to the base station on a nearly continuous basis, the FMS's state-of-the-art radio system also allows management to communicate non-verbally with drivers through the dashboard-mounted display screen.

Technology's payoff

The bottom line is that the technology allows the RCOC to provide more efficient winter road maintenance, thus saving money and providing safer roads for the motoring public.

The FMS was one of the systems of its type in the nation to be developed on a Web-based system. This allowed management team members to access the FMS information from anywhere that they have a computer with Internet access. Most previous systems relied on a tremendous amount of software that had to be loaded on every computer from which the system was accessed.

When first introduced, the FMS was one of the first major applications of its type in the nation. As a result, the project was watched closely by public agencies and private sector companies around the country, many of whom learned from and emulated the achievements of the FMS.